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engaged in broader forest study, especially in the tropics, have felt the severest need for ready or approximate identification by leaf characters. Secondly, an adequate study of fossil stems systematically collected, and including wherever possible to obtain, the circum-medullar region has never been even begun. Thirdly, the signal success with which Professor Nathorst has developed a chemical treatment of carbonized remains so that collodion imprints of many histologic features may be had, affords such an all-important factor of control that many of the longer known floras require restudy as a whole, or in part by this method. It is not probable that classification can be safely based on features disclosed by the "chemical method"; but as an aid in determining genera or species it is effective, often in the case of rather fragmentary material. Fourthly, the improved methods of sectioning coals, and fragmentary stems like those of the Kreischerville conifers, as developed by Jeffrey, indicate a great extension of exact study following more searching collection afield.

Under the circumstances we should have on at least ten of our surveys, and in at least a dozen of our larger universities thoroughly equipped paleobotanists. And need I call attention to the fact that the scientific requirements are severe? A good paleobotanist needs geologic and paleontologic, as well as botanic training, and above all things he needs to be not merely an expert in the laboratory but a rugged and determined field worker and collector. Such men have to be given position. Subsidiary activities, and foreshortened results, are apt to be near neighbors. Though the comparison be invidious, it yet requires to be made. In their larger collecting schemes both the invertebrate and vertebrate paleontologist constantly spend in collection and reconnaissance sums such as have never been even relatively available for work in the fossil plants not one whit less important.

In closing I would like to call attention to a point of concrete value. According to the interpretations of evidence which have thus far had acceptance, there results a lack of forest making types from the Trias to the close of the Jura. But if, as now seems apparent, the cycadeoids have a degree of angiospermous affinity, the microphyllous forms must often represent important elements in unrecognized forests. If so, many of the forms probably had the same capacity to thrive in temperate to colder climates as the dicotyls they often accompany, especially in the puzzling association noted by Hollick in the Kenai flora of Alaska.[2] This flora must have flourished near to snow fields and glaciers. The cold presaging the bipolar ice caps may therefore have come on far earlier than has been hitherto unquestioningly believed. This, with the new methods of study, and especially the more persistent scanning of the broader outlines of plant succession, is only one of the many problems which await development of paleobotany.

G. R. WIELAND

GRAVITATIONAL ATTRACTION AND URANIUM LEAD

TO THE EDITOR OF SCIENCE: As shown by Professor Theodore W. Richards in his presidential address,[1] it has been found that the last known disintegration product of the uranium series, uranium lead, behaves in all respects like ordinary lead, with the exception that it is slightly radioactive and has an atomic weight of about 206.1, as compared with that of ordinary lead, 207.2. It has also been found that lead derived from uranium minerals usually shows some value between the above limits and thus appears to be a mixture of the two former kinds. None of the many attempts made to effect a separation has, however, met with success, nor has any theory been advanced by which the discrepancies in atomic weight, which seem quite without a parallel among the other elements, may be satisfactorily explained.

The possibility suggests itself that the discrepancies referred to might be due to a slightly different behavior of the various forms of lead toward the force of gravitation. Whether or not this is so may easily be ascertained through physical tests which might preferably be in the nature of comparative pendulum measurements, lead derived from uranium ore being obtainable in sufficient quantities for the purpose.

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[1] "The Problem of Radioactive Lead," SCIENCE, January 3, 1919.

[2] See *American Journal of Science*, IV., 31, April, 1911, pp. 327–330.

The generally accepted law according to which the ratio of weight to mass has a fixed value in the same locality, irrespective of the nature of the substance, is largely empirical, as there are a number of elements for which the law has never been proved. Considering the very irregular distribution of other properties, like magnetism and radioactivity, among the elements it would not be surprising if deviations were found to exist in their gravitational properties as well.

From this point of view, *i. e.*, if deviations actually exist in the value of gravitational acceleration for the various forms of lead, the chances are that the value in any case will be proportional to the atomic weight, as in this instance the atomic mass, being the ratio of either, would come out the same for all forms of lead. Such a result would go far toward reconciling the discrepancies in atomic weight with already established theories, because what is really of interest, both from a physical and chemical standpoint, is not so much the weight of the atom as its mass. Weight is only an attribute of mass, the latter having long been recognized as the more basic entity.

The theories on gravitation are still in a crude shape, but if the attraction is assumed to be due to the movements of the electrons constituting the atoms a possible deviation in the gravitational attraction of uranium lead might perhaps be ascribed to a gradually subsiding state of tension or agitation among the electrons, caused by the splitting up of the atoms during the radioactive processes, conditions being thus comparable to those supposed to obtain in a permanently magnetized piece of steel. On this assumption uranium lead would, in course of time, increase in atomic weight, changing slowly into ordinary lead, while the lead derived from various uranium minerals might properly be considered as representing intermediate stages in this process of relaxation.

ANDERS BULL

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WORKING UP IN A SWING

TO THE EDITOR OF SCIENCE: Mr. A. T. Jones has an article on this subject in the current volume of SCIENCE, p. 20, July 4, 1919. In the beginning he makes a statement as follows:

> As I do not recall ever seeing any discussion of this matter, the following note may not be out of place.

I wish to call Mr. Jones's attention to E. J. Routh's "Dynamics of a System of Rigid Bodies" (Macmillan), Vol. I., Art. 287, entitled "Examples of Living Beings." In example 6 he will find a complete solution of his problem, with the necessary mathematical equations.

V. KARAPETOFF

CORNELL UNIVERSITY,
July 8, 1919

TO THE EDITOR OF SCIENCE: The letter in SCIENCE of July 4, by Professor Arthur Taber Jones, on "working up" in a swing, recalls to the writer that while studying the problem, several years ago he found several references to the subject.

In the *Zeitschrift für physikalischen und chemischen Unterricht*, 16, 230 1913, H. Lohmann describes an apparatus by means of which the process of "working up" may be demonstrated. This consists of a plunger electromagnet, suspended as a pendulum, with its axis vertical. Raising and lowering the center of gravity of the suspended mass is accomplished by means of a key which controls the position of the plunger within the solenoid. The circuit is closed, and the plunger (and therefore the center of gravity) is raised when the key is in the "up" position; the plunger drops a short distance when the key is depressed. By imagining himself in a swing, the operator has no difficulty in so manipulating the key that the raising and lowering of the center of gravity of the swing-